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Managing knowledge for asset management: Shifting from process to relational frames

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Abstract The purpose of this paper is to review existing knowledge management (KM) practices within the field of asset management, identify gaps, and propose a new approach to managing knowledge for asset management. Existing approaches to KM in the field of asset management are incomplete with the focus primarily on the application of data and information systems, for example the use of an asset register. It is contended these approaches provide access to explicit knowledge and overlook the importance of tacit knowledge acquisition, sharing and application. In doing so, current KM approaches within asset management tend to neglect the significance of relational factors; whereas studies in the knowledge management field have showed that relational modes such as social capital is imperative for effective KM outcomes. In this paper, we argue that incorporating a relational approach to KM is more likely to contribute to the exchange of ideas and the development of creative responses necessary to improve decision-making in asset management. This conceptual paper uses extant literature to explain knowledge management antecedents and explore its outcomes in the context of asset management. KM is a component in the new Integrated Strategic Asset Management (ISAM) framework developed in conjunction with asset management industry associations (AAMCoG, 2012) that improves asset management performance. In this paper we use Nahapiet and Ghoshal's (1998) model to explain antecedents of relational approach to knowledge management. Further, we develop an argument that relational knowledge management is likely to contribute to the improvement of the ISAM framework components, such as Organisational Strategic Management, Service Planning and Delivery. The main contribution of the paper is a novel and robust approach to managing knowledge that leads to the improvement of asset management outcomes.

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1 Introduction

Thus far, in managing engineering assets, there appears to be little cognizant when adopting integrated asset management approach that reflects the processes and interrelations between economics, engineering, information technology, sustainability and human elements of the organisation. Only recent research has begun to draw attention to the importance of integrated asset management approaches and calls for introducing human aspect into the management of organisational assets [1-3]. For instance, Schuman and Brent [3] emphasised that an early involvement of multi-skilled people from the operating, production and maintenance instils a sense of ownership in the asset project, suggesting that addressing concerns and viewpoints from multiple stakeholders involved in the project influence better decisions [3]. In these recent studies, asset management has been viewed as a socio-economic system including social components (culture, trust, social networks, leadership, culture, knowledge) and technical components (machinery, plant, etc) [2]. Interactions between these components determine the direction of system development, thus both components, social and technical, should be given equal relevance to ensure integrated asset management outcomes [2]. This means that the importance of the human issues, so far overlooked in asset management, has to be taken into consideration to ensure improved asset performance [1].

Integrated Strategic Asset Management Guide (ISAM Guide) developed in conjunction with asset management industry associations [Australian Asset Management Collaborative Group (AAMCoG), 4] provides a contemporary outline to assist those responsible for delivering and managing built assets to meet community and service delivery needs. ISAM Guide focuses on an integrated approach to managing assets by bringing together economics, engineering, information technology, sustainability and human elements and recognising interrelationships and interdependencies between these elements.

This paper aims to explain how the integration of these elements can be achieved through effective knowledge management efforts. According to AAMCoG [4] knowledge management involves information systems and effective knowledge management processes, underpins the capacity to develop new ways of thinking and creative responses that are necessary to improve decision-making and increase productivity. Nevertheless, KM in asset management domain is still immature. Many firms do not consider asset management as a business approach that integrates business activities. Therefore, knowledge related to asset management is often based on organisational information sources, which have been designed for other than asset management purpose [5]. Furthermore, existing approaches to managing knowledge for asset management focus primarily on the application of data and information management systems, i.e. asset register. Although these systems provide quality and timely data for decision makers, they primarily contribute to management of explicit knowledge and overlook the importance of tacit knowledge. The lack of relational approaches for managing tacit knowledge means that KM for asset management is only fragmentary. Such incomplete KM practices are likely to result in sub-optimal asset management performance.

2 Knowledge Management

In recent years, companies function in a rapidly changing and a knowledge intensive environment. In these conditions firms need to be highly competitive to achieve continuous growth in the industry. To accomplish this, companies need to ensure the best use of their organisational knowledge. This can be achieved through KM that enables effective organisation of knowledge in a company providing specified process for acquiring, organising, and sharing both tacit and explicit knowledge [6; 7]. The overall purpose of knowledge management is therefore to maximise the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to achieve competitive advantage [8].

In asset management, the importance of knowledge management has also been acknowledged by existing guidelines and standards [e.g. 9; 10]. However, these standards focus mostly on asset data and information management, giving limited attention to knowledge management, and overlooking a significant distinction between knowledge, data and information.

2.1 Knowledge – information – data

Knowledge is a multifaceted concept with multilayered meanings [11]. It has been described as a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information [12 p. 137]. Knowledge originates in the minds of knowledge holders and can be transferred into documents, organisational routines, processes, practices, and norms. It is necessary to distinguish knowledge from two other dimensions: data and information. In asset management, these terms are sometimes used interchangeably to knowledge, however, their scopes differ significantly.

Data is a set of discrete, objective facts about events. There is no meaning in data. Data provides no judgement or interpretation or basis of action [12]. Information is a message, usually in the form of a document or an audible or visible communication. It has a sender and a receiver, and moves around organisation through hard and soft networks. Unlike data, information has a meaning. Data becomes information when its creator adds meaning, for example by contextualising, condensing, or categorising it [12]. Once the information is used and becomes actionable, it is transformed into knowledge [12]. In other words, knowledge is created and organised by the flow of information attached to the commitment and beliefs of its holder [11]. When knowledge is learned and shared among individuals and adapted in organisational processes it becomes a valuable, intangible asset.

In asset management all three: data, information and knowledge are necessary. At several stages of the asset life cycle, information is required on the condi-

tion of the assets. Knowing what to measure, how to measure it, and what to do with the information becomes very important. Often information must be maintained for many years in order to identify long term trends [5]. There is a range of asset information systems available that provide access to different types of information captured in documents, drawings and photographs. These systems allow to record work activities related to an asset, forecast asset demand, capture data related to asset performance, serviceability, asset location and monitoring of asset condition; providing all sorts of asset attributes e.g. make, model, serial number, age, capacity, and subjective information about the asset [5; 9]. Although maintaining accurate and quality asset data and information is imperative, the ultimate purpose for collecting data and information is often to make an informed decision. This can be done only by making a meaning out of data and information and translating it into knowledge, which combines experience, values, information in context, and insight, thus forming a basis for decision making [9].

2.2 Relational Knowledge Management

Current approaches to managing knowledge in asset domain focus primarily on the application of data and information systems (i.e. asset register). It is contended these approaches provide access to explicit knowledge, but overlook the importance of tacit knowledge acquisition, sharing and application. Furthermore, as highlighted by Laue, Brown and Keast [1], these information systems deal primarily with categorising and providing asset information, but they do not overcome barriers of knowledge management related to education and communication, trust-building and team enabling activities, or establishing a climate of continuous learning [13].

According to The Institute of Asset Management [9], the quality of knowledge as derived from the experience, values, information in context, and insight, will affect the reliability and quality of decision making. So not just a good data, but good knowledge is required to forecasts future behaviours and assist in asset management decision making. Therefore, incorporating a relational approach to KM is more likely to improve knowledge management behaviours while contributing to the exchange of ideas, thus improving decision-making in asset management. We define relational KM in the context of asset management as:

The ability to capture, share, apply and integrate experiences, values, contextual information, and expert insights through formal and informal channels in order (1) to improve the capacity needed to develop new ways of thinking and (2) to generate creative responses necessary to improve asset management decision-making.

Existing research found that social networks such as informal meetings, coffee breaks, and workshops are essential for effective knowledge sharing [14-18]. Databases have grown to large proportions, but are often underutilised as employees are much more likely to turn to peers and colleagues than to impersonal sources for necessary knowledge [18]. Additionally, Mintzberg [19] indicated that people prefer to turn to other people rather than documents for information. More recently, the same tendency has been found even for people with ready access to the Internet and their firm's IT-based knowledge repository [20]. Newell et al. [21] recognised that social networks and informal dialogue are more effective than IT techniques and that IT should only complement social networks in knowledge transfer activities.

2.3 Knowledge Management From the Lens of Social Capital

Social capital is a set of social resources embedded in relationships [22]. Social capital includes many aspects of a social context, such as social ties, trusting relations, and value systems that define relationships, thus facilitate actions of individuals located within that context [23].

In this paper, we present the view on relational KM from the perspective of social capital, based on the model outlined by Naphiet and Ghoshal (1998). The model refers to three dimensions of social capital: structural, cognitive, and relational. *The structural dimension* includes network ties, which represent connections among members participating in social exchange. Network ties provide access to resources based on the principle that 'who you know' affects 'what you know' [24]. Maintaining strong ties, demonstrated by frequent and close social interactions, allow actors to know one another, to share important information, and to create a common point of view [23]. Furthermore, specific network configurations, such as density, connectivity and hierarchy influence the way how knowledge is shared between members. Therefore, social relations based on maintaining healthy network systems are likely to perform more effectively than sophisticated information systems. This is because social relations reduce the amount of time and investment required to gather information improving the ability of personal contacts to provide information sooner than it becomes available to people without such contacts [24]. Early access to knowledge may be especially important in time-constrained project driven environment, where asset management operates. *The cognitive dimension* of social capital refers to shared language, codes, stories and metaphors, and provides powerful means in communities for creating, exchanging, and preserving knowledge. Tsai and Ghoshal [23] argue that when organisation members share the same vision, they can avoid possible misunderstandings in their communications, thus exchange knowledge more effectively. *The relational dimension* is characterised by a high level of trust, shared norms, obligation, and identification [24]. For example, existing research identified trust as an

important factor for successful knowledge sharing [25-27]. Koskinen et al. [28] noted that the greater the level of trust, the greater the level of people accessibility, and the greater the chance knowledge is shared in the team. Furthermore, Inkpen and Tsang [25] agreed that an atmosphere of trust contributes to the free exchange of knowledge, because people do not feel they have to protect themselves from others' opportunistic behaviours.

Overall, existing research has shown that building social capital improves relational KM. Tsai and Ghoshal [23] found that the structural and relational dimensions of social capital were significantly related to the extent of resource exchange, which in turn led to product innovation. Furthermore, Levin and Cross [26] revealed that relational dimension of social capital, in particular the trust, improves transfer of knowledge between teams. From these past research, it is therefore apparent that trust and strong ties influence the formation of social capital and improve KM. In this research we explain how relational KM, influenced by social capital, improves asset management outcomes. Next section focuses on explaining how relational KM contributes to ISAM framework components, namely *Organisational Strategic Management, Service Delivery and Community Needs and Expectations*.

3 Improving Asset Management Through Relational Km

3.1 Organisational Strategic Management

According to ISAM Guide, Organisational Strategic Management involves an understanding of governance, corporate policy, objectives and corporate strategy. It gives effect to whole-of-government policy through service delivery helping to determine how the delivery of asset and service should occur and what is required [4]. Consequently, Organisational Strategic Management involves the ability to access and leverage existing social and organisational relationships and utilisation of organisational capabilities including skills, expertise and knowledge.

Turoff [29] advises that strategic planning, such as policy and asset procedures development, should normally take place during sessions with a group of experts across organisational departments and levels including company board, asset managers as well as operation, maintenance and engineering representatives. This is because input from a range of actors will ensure that the decision maker is making optimum choice on the policy development or adjustment [29]. Accordingly, the better the knowledge base upon which policies are built, the more likely they are to succeed [30; 31]. In particular, good asset management policies, goals and plans are likely to emerge when there is a good amount of knowledge shared between policy makers and other stakeholders involved in asset management. Ex-

changing valuable expertise and insights between participants during the policy development process, while taking into account knowledge from other stakeholders involved in asset management, is then likely to ensure that all possible options have been put on the table for consideration. So the policies, asset management strategy, plans and goals are attainable, relevant and understood across the organisation and beyond its boundaries.

Prior research identified that utilisation of informal networks and personal knowledge supports the knowledge base for policy-makers [32]. According to Riege and Lindsay [31] when creating public policy, stakeholders may include a range of people or organisations whose interest may be positively or negatively affected, such as government or private organisations, local authorities, the general community, and other interested parties. Riege and Lindsay [31] argue that enhanced partnerships with those stakeholders provides a cost-effective way of obtaining good quality knowledge. Based on that, knowledge input from stakeholders affected by and engaged in asset management practices is likely to improve knowledge creation and enhance knowledge data base for asset management. Corporate policy and strategy developed through ongoing knowledge sharing between decision makers and other stakeholders engaged in asset management activities, and followed by ongoing review, may then lead to improved Organisational Strategic Management outcomes.

3.2 Service Delivery

In the context of asset management, service delivery is a transaction aimed at meeting the needs and expectations of clients [33]. Appropriate planning on strategic, tactical and operational levels is therefore imperative to achieve desired service delivery outcomes [4] ensuring that asset in fact delivers required service on time, within the budget and to the right quality. Effective use of skills and knowledge of all the parties engaged in the asset management can assist in the service delivery planning process. For instance, expert involvement can provide useful knowledge and expertise in the development of acquisition, maintenance, operation and disposal plans [4]. Accordingly, appropriate solutions for service delivery depend on a range of stakeholders, with diverse interest and influence. These stakeholders may include other government agencies, asset users and the broader community [4].

Dawson [34] argues that to achieve high value service delivery outcomes it is important to partner up with other services providers. For this reason firms often form temporary ventures – project-based organisations [35], which by blending internal and external skills, expertise and knowledge, can meet a variety of client needs in a rapid and effective manner [36]. This approach is especially common in the public sector where Government resolves its financial and resources constraints in the provision of services by using skills, knowledge and resources of

private organisations to increase the efficiency, effectiveness and quality of facilities and services delivery [37].

A number of different parties engaged in project-based organisations, including project team members, contractors, subcontractors, clients, and other stakeholders, means that these entities have strong knowledge capabilities, but it also suggests that to make the best use of it, effective knowledge coordination in project-based organisations is essential. However, despite the clear benefit to involve a range of skills and capabilities in service delivery activities, government agencies face a challenge to integrate these skills and to achieve consistency and transparency when delivering projects. Dawson and Horenkamp [36] advises that building knowledge-based relationships between the agencies as well as between agency and contractors and other stakeholders will improve service delivery outcomes and enhance knowledge capabilities, thus facilitate intra- and inter-firms knowledge sharing. To be effective these relationships need to be based on mutual trust and willingness to disclose information while being open to new ideas. According to Dawson and Horenkamp [36], clients in such a knowledge-based relationships are less affected by price because they realise the role of open communication, collaborative teams, and complementary expertise in creating value.

3.3 Community Needs and Expectations

According to ISAM Guide, understanding community needs and expectations is vital when delivering services [4]. Building strong and trusting relationships with communities and other stakeholders engaged in asset management endeavours is likely to be a driving force for understanding needs and expectations necessary to identify service and asset demands. Nevertheless, government agencies only inform communities and do not actively engage them into decision making process, whereas Riege and Lindsay [31] suggest that government needs to focus on two-way KM processes that is not only obtaining knowledge from communities, but also transfer certain knowledge back to them. It has to be also taken into account that different communities may have diverse views and varying capacities to interact effectively. Riege and Lindsay [31] brought to attention that some groups will be more than others capable at representing themselves and therefore capable of engaging effectively in service delivery with government. According to Friis [38], one of the main reasons for government failure in this area seems to be too much emphasis on technology, rather than management processes that encourage people to interact. Based on that, community participation, critical to understanding service demands, can be enhanced through relational approach to KM. This can be achieved by creating opportunities for face-to-face interactions that in a longer term build stronger relationships and enhance mutual trust between government agency and community groups. Accordingly, the relational KM approach will allow for more effective management of various and often conflicting expectations.

In a view of what has been said, relational KM is expected to assist organisation in achieving greater community participation, knowledge sharing, and demonstrate accountability.

4 How to Improve KM for Asset Management

This paper argued that focus solely on data and information management systems is insufficient for asset management to improve its outcomes and that shifting towards relational frames, based on building strong and trusting relationships is more likely to facilitate the access to both tacit and explicit knowledge. Leveraging social and organisational relationships will allow to fully utilise organisational capabilities including skills, expertise and knowledge. This in turn will contribute to organisational strategic management, service delivery outcomes, and meeting community needs and expectations – components of integrated strategic asset management.

There are number of ways to improve relational KM. Building social networks through the creation of formal and informal channels such as scheduled and unscheduled meetings, informal seminars, training sessions, plant tours has been found to improve the distribution of highly context-specific tacit knowledge [6]. In the context of asset management this means that well established social networks are more likely to create opportunities for novel ideas to emerge and improve decision making though better informed assessment of a problem at hand. One way to do this is to organise frequent meetings with stakeholders and community members during which asset and service delivery demands and expectations are openly discussed. Also, early involvement of parties engaged in later stages of asset management life cycle, including operation and maintenance representatives, is expected to improve decisions related to planning and design of the asset. Furthermore, when developing organisational asset management policies and strategy it is recommended to facilitate sessions with a group of experts across organisational departments and levels including company board, asset managers as well as operation, maintenance and engineering representatives. Using techniques such as focus groups or Policy Delphi can assist in getting experts together and creating opportunities for knowledge sharing between them [39], thus assist in more desirable outcomes for Strategic Organisational Management.

Another way to improve relational KM is to create environment for trust building. To intentionally create trust or manage another party's propensity to trust is a difficult task. However, it is possible to enhance conditions for trust-building. Trust is a predictor of positive working relationships between stakeholders, increasing the willingness of various project stakeholders to cooperate [40]. Organisation can create trust building environment by reviewing organisational norms and practices that encourage or discourage the high frequency of interaction and collaboration, supporting and recognising KS initiatives, endorsing and maintain-

ing a friendly and non-competitive atmosphere at work while creating an atmosphere for learning and not blaming [18; 41]. Trusting relationships established among parties involved in the asset management planning processes are then likely to create environment of confidence and openness, thus positively contribute to problem solving.

Finally, it is important to recognise that relaying solely on relational KM may not be sufficient. As Cooper [42] noted, during face-to-face interactions issues are often raised and forgotten because attention is diverted elsewhere. Decisions are made based on sketchy information that is not revisited. Opportunities are lost because no one is accounted to follow up on them [42]. Therefore, incorporating relational approach to KM into existing technology based mechanisms appears to be the most optimal way to bring the best outcomes when managing knowledge for asset management.

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